

A REVISION OF THE GENUS *PHILINE*  
IN NEW ZEALAND WITH DESCRIPTIONS OF  
TWO NEW SPECIES  
(GASTROPODA OPISTHOBRANCHIA)

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Plate 3

SUMMARY

The Tertiary and Recent species of the genus *Philine* in New Zealand are reviewed. Two new species are described, one from both the Recent fauna and Pleistocene (Castlecliffian) deposits, the other only from the Castlecliffian. The other species recorded from New Zealand are re-described and photographs of the type specimens are included. Suter's type material of *Philine auriformis* contains three different species, two of the genus *Philine* and one of *Aglaja*.

INTRODUCTION

The bullomorph opisthobranchs are very poorly known biologically. Many species have been described on the basis of the shell alone, and although in some cases this is valid, it has led to much confusion amongst later workers as to what name should be given to what species. While engaged in biological studies on the group, I have collected specimens and descriptions in anticipation of a taxonomic revision of these opisthobranchs. The name *Philine auriformis* has been used for at least three different species, and although there is a common animal with a shell similar to Suter's shell description, it has a radula that differs from that of Suter's species. It was therefore decided to review the New Zealand species of *Philine*. This review has ignored the anatomy of the species involved, not because this is unimportant but because the significance of anatomical differences from species to species is still not clear. It was found that the shell, gizzard plates and radula provide sufficient differences on which to base specific descriptions.

The following abbreviations have been used in the collecting records: S.R.C. — Suter Reference Collection, Geological Survey; N.Z.G.S. — Reference number for N.Z. Geological Survey Collection; B.S. — Dominion Museum Bottom Station reference number; and M. — Dominion Museum reference collection number.

DESCRIPTIONS

Genus *PHILINE* Ascanius, 1772

Type species: *Bulla aperta* Linné, 1767.

Opisthobranch mollusc, usually white, large head-shield often two-thirds body length, parapodial lobes extending along both sides of body. Shell internal, ovate or subquadrate thin and fragile, smooth, spirally striate or punctate, consisting of a few loosely convoluted whorls, entirely

open from below. Spire immersed, aperture very large. Gizzard plates three, calcareous, sometimes similar in shape, sometimes not. The radula formula varies from 1.0.1. to 6+1.0.1+6; the inner laterals being of typical shape as described below for *Philine angasi*, the outer laterals are small and degenerate either as in *Philine auriformis* or as in *Philine alba* Mattox, 1958.

*Philine auriformis* Suter, 1909

Fig. 1 B-E, 2 P, Pl. 3, D-F, H, O.

Synonymy: *Philine angasi* Hutton, 1880: 123, *Non Crosse* and Fischer, 1865.

*Philine constricta auriformis* Suter, 1909.

Shell auriform, almost quadrangular, more calcified than *P. angasi*. Sculptured by spiral markings, bead-like in pattern, each separated by a wider smooth area. Growth lines visible. Colour white, spire immersed, body-whorl very large, flatly convex, open from below. Outer lip narrowly convex and projecting slightly beyond the spire above, and slightly rounded below on joining the basal lip. Basal lip oblique and straight, seldom convex, arching toward the high oblique and very thin columella. Inner lip hardly visible. Size: Lectotype, height 8.8 mm, width 7 mm. Paralectotype, height 9.2 mm, width 7.5 mm. Large specimen from Manukau Harbour, height 16 mm, width 12 mm.

Animal elongate, flattened, white to cream in colour. Orange of buccal bulb and gizzard visible dorsally. Head shield long, usually two-thirds body-length, having anterior median indentation and distinct median longitudinal groove. Posterior third of dorsum quadrangular, enclosing shell and extending ventrally on each side to enclose mantle cavity. Parapodial lobes not muscular, extending posteriorly down each side of the body from just behind the head to just beyond head-shield. The brown leaflets of Hancock's organs are visible on each side of the anterior body. Four sensory pits are situated around the mouth.

Gizzard very large, between two-and three-fifths the body length. Gizzard plates identical in shape, one lying dorsally the other two ventrolaterally. Plates spindle-shaped in outline, inner surface convex; outer face hollowed out on each side of central longitudinal flat bar, without perforations as in *Philine angasi*.

The radula contains 18 rows of four teeth, of which seven rows are functional and the other eleven replacements. Inner teeth are of typically philinid shape, having triangular basal plate extending into an incurved hook, bearing recurved denticles on inner edge. Outer row of teeth much reduced, having thin rectangular basal region, the longest side being in vertical plane, extending up into an even thinner elongate process. These teeth are neither curved nor denticulate.

*Types.* Lectotype and paralectotype in the New Zealand Geological Survey Coll., Lower Hutt, labelled T.M. 1192 and T.M. 1193 respectively, collected at Akaroa Harbour in 4-6 fathoms.

*Collecting Records.* Herne Bay, Auckland; Ngataringa Bay, Auckland; Cheltenham Beach, Auckland; Ihuamatao, Manukau Harbour, Whakati-

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waiwai, Firth of Thames (coll. W.B.R.); Port Pegasus, Stewart Is. (Coll. E. Batham); Wet Jacket Arm, Resolution Is. in 12 faths. (S.R.C. 3453); Tahuna Beach, Nelson (N.Z.G.S.2186); Oneroa Beach, Waiheke Is. (N.Z. G.S.2189). It has been recorded from N.Z. Tertiary deposits (Fleming, 1966).

This species is apparently common throughout New Zealand both intertidally and in deeper water, burrowing in fine sand and sandy-mud. The author found it to feed on the bivalve *Nucula hartvigiana*. The shell and gizzard plates of a specimen of *Philine*, collected by W. S. Ayers from 40 fathoms off Lakes Entrance, Victoria, Australia were sent to me by Mr. R. Burn, for examination. I have tentatively identified them as belonging to *P. auriformis*. Until a whole animal is available, I am not willing to positively identify this specimen and so increase this species' range to Australia.

*Discussion.* Following the description of the next species is an explanation of the type material of *Philine auriformis*. In this account it is suggested that Suter's description of the radula of this species is incorrect, the correct formula being  $1+1.0.1+1$  rather than  $1.0.1$ . The mistake was probably the result of the poor instruments available to Suter, the outer rows of degenerate teeth being rather difficult to see.

*Philine powelli* sp. nov.

Fig. 2 N-O, Pl. 3, I-N.

*Synonym; Philine auriformis* Powell, 1937, et seq.; pl. 10, figure 22, non Suter, 1909.

Shell auriform, more calcified than in *P. angasi*. Sculptured on outer surface by strong spiral pitted grooves producing a punctate pattern. Inner surface of shell heavily glazed. Colour white, spire sunken, body whorl very large, convex and open from below. Outer lip extending beyond spire, forming a spinous process. Spine often denticulate through extension of strong spiral ridges that sculpture the upper end of the shell. Basal lip straight, sometimes oblique. Inner lip, a thin calcareous layer over the parietal wall. Size; holotype, height 8.2 mm, width 6.0 mm; paratype, height 4.8 mm, width 3.5 mm (B.S. 153).

Animal. Although only preserved animals were available for study, certain important features were visible. The animal is flatter and more muscular than *P. auriformis*, being nearer *P. angasi* in shape. Head-shield probably extends only halfway down body and parapodial lobes are thick and muscular, as in *P. angasi*, forming body into hard wedge-shaped animal. Paratype from B.S. 153, measured 6.5 mm x 5 mm. Hancock's organs and sensory pits around mouth are present.

Gizzard large, containing three identical calcareous plates. Because of partial decalcification, shape was difficult to determine. Similar to *P. auriformis* in having median bar on outer surface of plate. Radula, 14 rows, formula  $1.0.1$ . Teeth typically philinid in shape with recurved denticles on the inner edge.

*Types.* Holotype; Shell deposited in Dominion Museum, Wellington, number M.7970.

Paratypes; 1; Radula, gizzard plates and shell deposited in Dominion Museum.

2; Radula and shell deposited in Dominion Museum.

The holotype was collected from B.S.143, "Kotuku" Expedition. 39° 30.5's., 177° 06'E. Hawke Bay in 16 fathoms, collected by J. A. F. Garrick, 20 May 1952. Paratype 1 B.S.155, 39° 27.5'S., 176° 54'E., Hawke Bay in 8 fathoms, and paratype 2 B.S.153, 39° 25.5'S., 176° 58'E., Hawke Bay in 10 fathoms, also collected by J. A. F. Garrick.

*Collecting Records.* Paraparaumu, Wellington, R. K. Dell, 1948, Dom. Mus.Coll.; Tokomaru Bay, 45 fathoms, N.Z.G.S. 2185; Waikanae Beach, Wellington, W. F. Ponder, August 1956, Dom.Mus.Coll. M.9900; Sealers Bay, Codfish Is. coll. R. K. Dell, 5 November 1948 (Dom.Mus.Coll.) M.7879, B.S.170, off coast of Manawatu, 40° 42'S., 174° 10.6'E. "Alert" Station K, in 58 fathoms. 2 September 1951 (Dom.Mus.Coll.).

Fossil material has been found; one broken specimen (Pl.1m) N.Z.G.S. 4103. Castlecliff Section, "Tainui Zone", Wanganui N137/353. Age; Castlecliffian Stage, Putikian Substage, coll. C. A. Fleming, 23 January 1945.

*Discussion.* *Philine powelli* has been mistakenly identified as *P. auriformis* by a number of workers. Specimens in the Dominion Museum have been so named, as has a specimen illustrated by Powell (1937 et seq.: pl. 10, fig. 22). This species was found alive in some numbers in dredgings taken in Hawke Bay by the "Kotuku" Expedition in 1952, and shells have been washed up around the Wellington area. Further studies could show that this species is widely distributed in New Zealand. The broken shell from the collection of the N.Z. Geological Survey labelled *Philine cf. auriformis* N.Z.G.S. 4103 is most probably a broken shell of a large specimen.

*Philine teres* Hedley, 1902, recorded from Tasmania (Macpherson, 1958) and New South Wales (Iredale and McMichael, 1962) is similar to this species, having the upper lip attenuated. However, from illustrations, the sculpturing and shape of the shell are quite different. The genus, *Yokoyamaia* Habe, 1950, has been erected for two Japanese species of *Philine*, *P. pygmaea* Yokoyama and *P. argentata* (Gould, 1860) with the latter as type species. *P. argentata* is distinguished by a dentate spine on the outer lip, as in *P. powelli*, and a plate-like fold on the parietal wall. The other species has the fold, but not the spine (Habe, 1955, 1964). The original definition of the genus *Yokoyamaia* is; "Shell like *Philine*, but with the posterior lip strongly produced and dentate. It bears a distinct fold on the inner wall and sculptures with punctate grooves. Radula formula 2.0.2, the inner marginal tooth larger than the outer; stomachal plates fusiform and brownish in colour."

I do not consider that each new combination of radula formula and shell shape should result in the erection of a new genus, and feel justified in relegating *Yokoyamaia* to the synonymy of *Philine*.

The species has been named in honour of Dr. A. W. B. Powell, who has recently retired from the positions of Conchologist and Assistant Director of the Auckland War Memorial Museum.

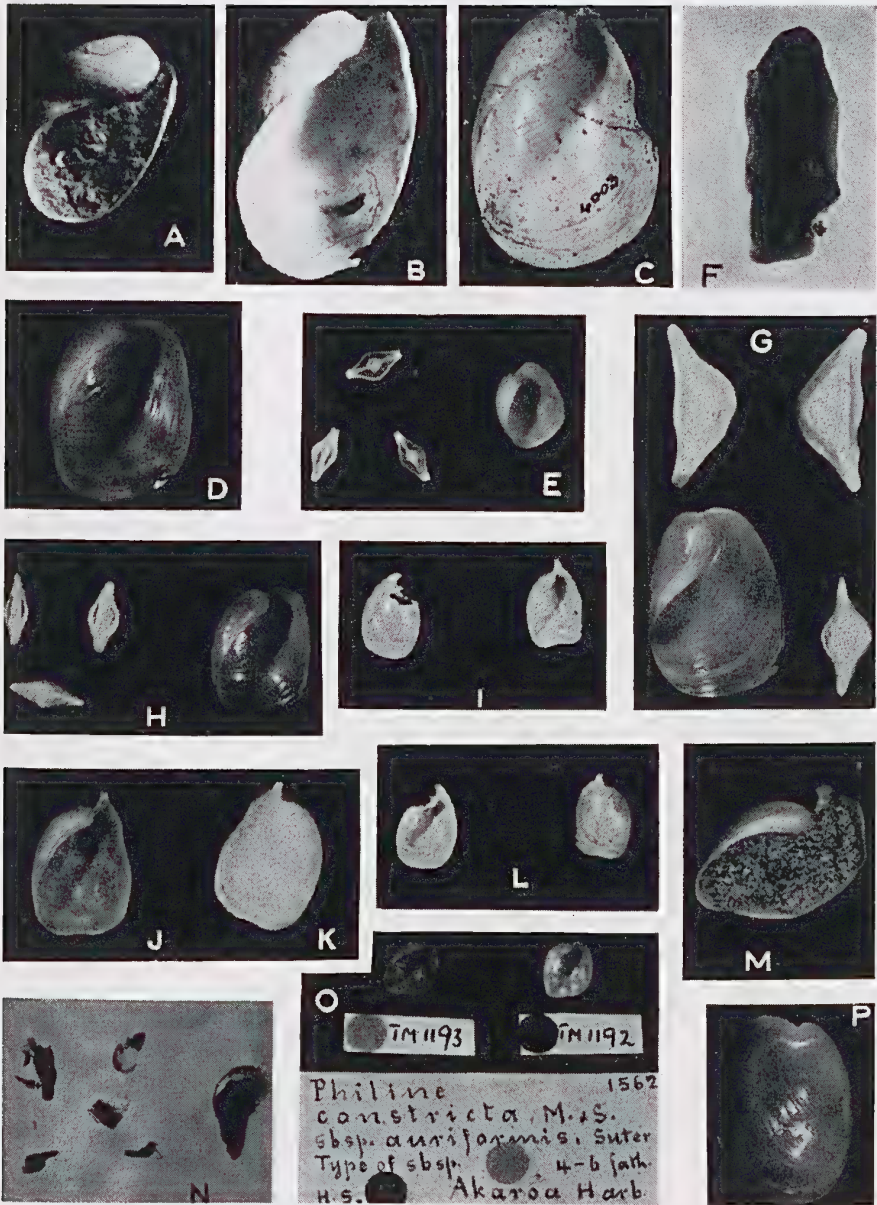


PLATE 3. A, *P. umbilicata*, holotype. B, *P. constricta*, holotype. C, *P. tepikia* n.sp., holotype. D, E, *P. auriformis*. D, large specimen from Whakatiwaiwai, Firth of Thames. E, shell and gizzard plates, Herne Bay, Auckland. F, dissected animal from Suter's type material. G, *P. angasi*, shell, gizzard plates, Cheltenham Beach. H, *P. auriformis*, shell, gizzard plates, Ihuamatao, Manukau Harb. I-N, *P. powelli* n.sp. I, L, paratype 1 on right, paratype 2 on left. J, K, holotype. M, fossil. N, dried animals of *P. powelli* from Suter type series of *P. auriformis*. O, *P. auriformis*, lectotype (right), paralectotype (left). P, *P. angasi*, shell, Cheltenham Beach.

THE SUTER TYPE SERIES OF *PHILINE AURIFORMIS*

Suter's type series of *P. auriformis* presents an example of the confusion that can be caused when a holotype is not chosen by the original author. This material was kindly lent to the author by Dr. C. A. Fleming from the collection of the N.Z. Geological Survey. It was in two parts; the first was in a plastic box which contained two tubes, both labelled 1562, and the smaller contained three gizzard plates, labelled (no doubt by Suter) "stomach plates". The larger tube contained two shells one apparently from a live animal and labelled with a card bearing T M 1192 and a red spot. The other is discoloured and was probably collected dead. It has a card bearing T M 1193 and a green spot. These two shells have previously been selected as lectotype and paralectotype respectively (Boreham, 1959). The shape of these shells and the dimension of the lectotype are similar to the shell originally described by Suter. No radula mount was available.

The second part of the type series was in a bottle bearing a label similar to that on the plastic box (Pl. 3, O). In this were a number of dried up animals which were partially reconstituted by detergent. There were three different species of opisthobranch in this material:

- (i) One animal (approx. 16 x 5 mm) in which the buccal bulb, radula and shell were missing. This carcass is probably the specimen from which Suter obtained the radula, gizzard plates and shell of the lectotype, (Pl. 3, O).
- (ii) Two complete animals and parts of three others of *P. powelli* n.sp., (Pl. 3, N).
- (iii) Three complete animals of *Aglaja lorrainae* Rudman, 1968.

*Philine powelli* and *auriformis* are distinguished by the shape of the shell and the radula formula. Suter's description of *P. auriformis* was of a species with a radular formula 1.0.1, and a shell without a spine on the upper lip. However the only species found in New Zealand with this type of shell has a radular formula 1+1.0.1+1. *P. powelli* has a radular formula of 1.0.1. It is possible that Suter described *auriformis* from the shell of one species and the radula of another. As the shell chosen as the lectotype is easily recognised from Suter's description, it must stand. *P. auriformis*, as redescribed above, differs from the original description as far as the radula is concerned. Suter probably dissected only one animal and was mistaken with the radula.

Suter's mistake is readily explained; all the animals are white, with internal shells, and were possibly taken in a single dredge haul in Akaroa Harbour. If the first animal he dissected had a shell similar to the dead shell he also collected (the paralectotype), he probably saw no need to dissect any more animals. This material also extends the range of the recently described *Aglaja lorrainae* from Nelson to Akaroa Harbour. The specimens from the Suter type series have been separately labelled and are deposited in the collection of the New Zealand Geological Survey, Lower Hutt.

*Philine constricta* Murdoch and Suter, 1906

## Pl. 3, B

Shell small, thin, convolute, imperforate, spirally grooved, auriform, slightly contracted above. Sculpture of shallow, fine spiral grooves, with

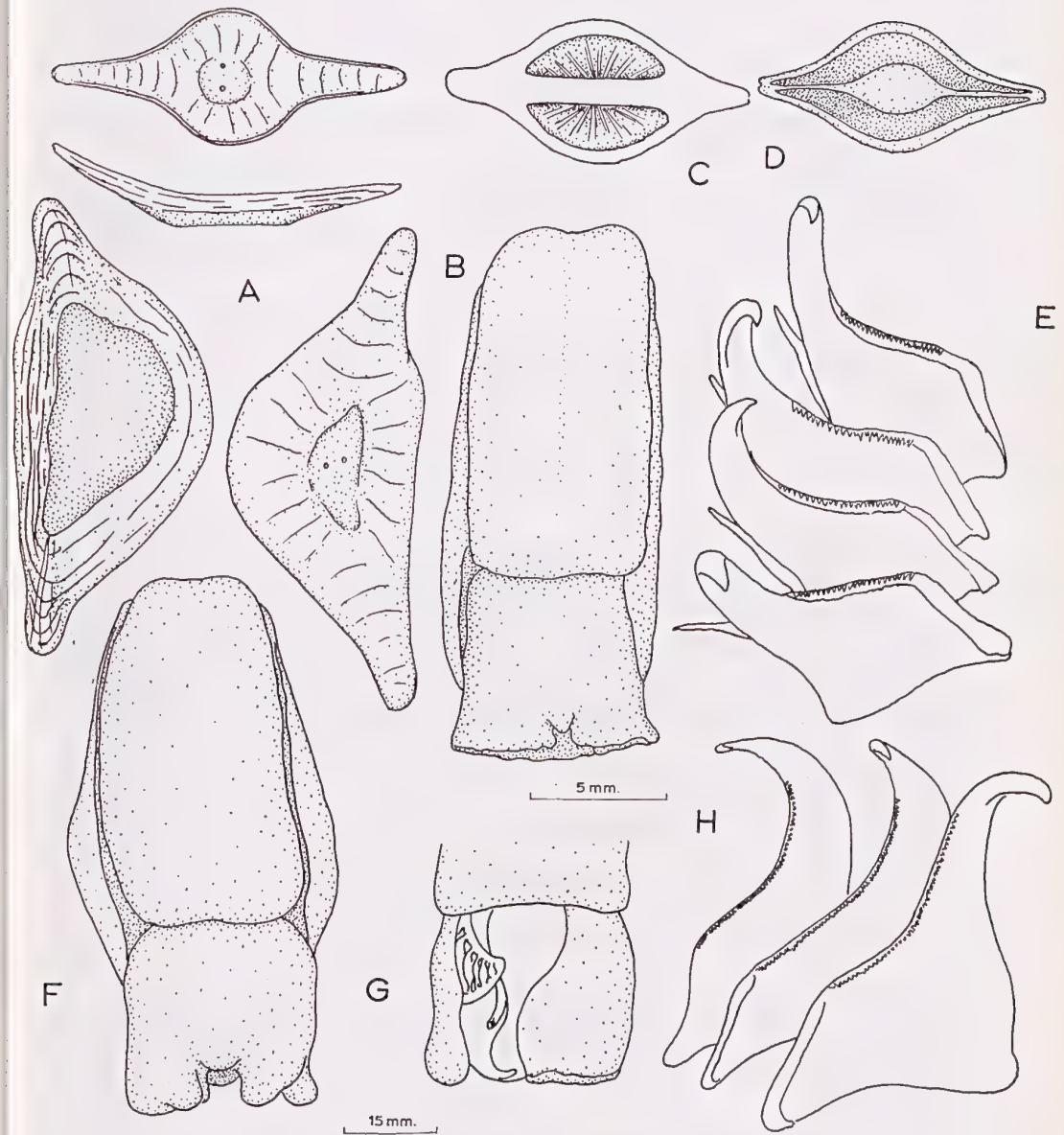


Figure 1. A, F-H. *P. angasi*. A, gizzard plates. F, animal. G, ventral view of mantle region. H, radula. B-E, *P. auriformis*. B, animal. C, outer side of gizzard plate. D, crushing side of gizzard plate. E, radula.

broader bands between, crossed by irregularly arranged growth lines. Colour white. Whorls one and a half, very rapidly increasing, the last very large, contracted below the vertex. Aperture elongately oval, acuminate above. Outer lip slightly convex, lower or basal lip regularly rounded. Inner lip forming a broadly spread callosity upon the parietal wall. Size of the holotype; height 5 mm, width 3 mm.

*Type.* The holotype is in the Dominion Museum, Wellington, M.1720, taken from off Great Barrier Island in 110 fathoms.

*Collecting Records.* The following specimens are deposited in the Dominion Museum M.10630, Chatham Rise; M.2793, off North Cape; M.2794, East end of Hen and Chicken Is., Hauraki Gulf; M.12379, Petre Bay in 94 fathoms, Chatham Is. It is recorded from N.Z. Tertiary (Fleming, 1966).

*Discussion.* This species has yet to be found alive. The above description is essentially that of the original authors. The species is quite distinct from any other yet described and approaches *Scaphander* in general shape.

*Philine umbilicata* Murdoch and Suter, 1906

Fig. 2L, Pl. 3, A.

Shell small, oval and truncate above, umbilicated. Sculpture inconspicuous, distant fine microscopic lines crossed by irregular and often raised growth lines. Colour white. Spire slightly immersed. Whorls two, very rapidly increasing, the last truncated above, rounded at the base, narrowed and flatly convex above. Aperture elongately oval, slightly excavated above the body whorl, broad and open towards the base. Outer lip thin, sometimes straight, usually concave for the upper half then forming a regular arch with the convex basal lip. Inner lip forming a rather broad but thin callosity upon the parietal wall. Umbilicus very distinct, formed by gap between parietal wall and columella. Size of holotype; height 3.5 mm, width 2.25 mm.

*Type.* The holotype, deposited in the Dominion Museum, Wellington, M.1721, was dredged from 110 fathoms off Great Barrier Island.

*Collecting Records.* Two specimens are deposited in the collection of the Geological Survey: N.Z.G.S.55, 110 fathoms off Gt. Barrier Is., coll. H. Suter; N.Z.G.S.2190, Dags Sound in 58 fathoms (New Golden Hind Expedition, No.80). It is recorded from N.Z. Tertiary (Fleming, 1966).

*Discussion.* This species has seldom been collected and as far as is known, no live animals have been collected. As the original authors stated, this species is distinguished by the almost total lack of spiral sculpture and the presence of a distinct umbilicus, which is an exception in the genus.

*Philine angasi* (Crosse and Fischer, 1865)

Fig. 1A, F-H. Pl. 3, G, P.

Shell fragile and thin, ovately subquadrate. Whorls  $1\frac{1}{2}$ , the last very large and open, sides of penultimate whorl almost parallel. Spiral sculp-



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ture not visible, but growth lines clear. Inner lip a calcification over the parietal wall. Size of shell; to 40 mm in length (Macpherson and Gabriel, 1962). Specimen from Cheltenham Beach measured 25 mm x 18 mm.

Animal white, roughly diamond-shaped, the parapodial lobes thick and muscular; anterior body cavity occupying only relatively small volume of body. Animal flat, having two brown sensory regions above the mouth and two below it. Hancocks organs present, but not easily visible.

Gizzard large, with three plates each of a different shape, the shapes and position of each being constant within the species. Two plates are large and mirror images of each other, triangular, the long side being either straight or slightly concave, the other sides being equal and slightly convex. One of these plates is mid-dorsal, the other occupying a right ventro-lateral position. The third plate is smaller and is placed left ventro-laterally. This plate is symmetrical and spindle-shaped. The plates have a convex inner and a concave outer surface. At the centre of the outer surface of each are two small holes.

Radula formula 1.0.1., teeth of typically philinid shape, having a broad slightly curved base and rising to a recurved point. The inner edge of each tooth is incurved and bears minute denticles. Normally eleven functional rows of teeth and fourteen rows in the radular sac. The very small size of the radula of this species, relative to the size of the buccal bulb, indicates that in this species the radula is of little use in feeding.

*Type.* The type and its whereabouts are not known. Iredale and McMichael (1962) suggest that the type locality is St. Vincent Gulf, South Australia.

*Collecting Records.* New Zealand: Paua Bay, Parengarenga Harbour; Whakatiwaiwai, Firth of Thames; Cheltenham Beach, Auckland. Australia: Southern Queensland, New South Wales, Victoria, Tasmania, South Australia, and southern Western Australia (Macpherson & Gabriel, 1962; Burn, 1966A; 1966B).

*Discussion.* This species is common in southern Australia and not uncommonly found at times in northern New Zealand. Found burrowing on sand-flats and sandy-mud flats, feeding on small bivalves (*Chione* in New Zealand).

*Philine tepikia* sp.nov.

Fig. 2M, Pl. 3, C.

Shell white, more calcified than *P. angasi*, but similar in outline, having rounded basal lip. Inner lip and inner whorls occupying upper left quarter of shell whereas in *P. angasi* inner lip extends into lower left quarter. Spire slightly sunken, pit so-formed sculptured with deep spiral ridges (Fig. 2M). Growth lines irregular but often very distinct, forming transverse ridges accross outer surface of the shell. Irregularly and widely spaced, deep spiral grooves present on upper half of body whorl. Size of type; height 29.5 mm, width 22 mm.

*Types.* The holotype is deposited in the collection of the N.Z. Geological Survey. N.Z.G.S. 4003. It was collected from Landguard Sand, Landguard Bluff (below road junction, 16 chains at 90° from Landguard Trig.),

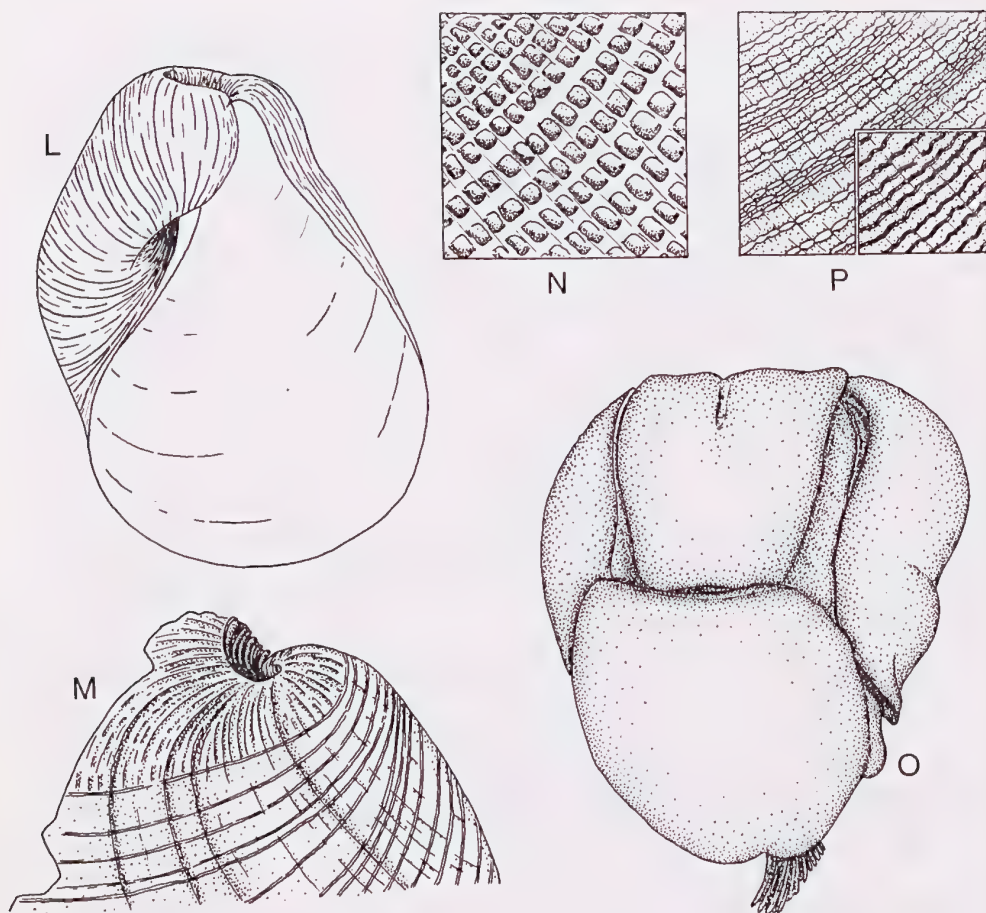


Figure 2. L, *P. umbilicata*, 58 fathoms, Daggs Sound. M, *P. tepikia* n.sp., holotype, showing sculpturing of shell. N-O, *P. powelli* n.sp., N, sculpturing of shell. O, animal of paratype (preserved). P, *P. auriformis*, sculpturing of shell, (inset, sculpturing of large shell).

Wanganui, N138/394; age: Castlecliffian Stage (Putikian Substage); Collected by C. A. Fleming, A. C. Beck, 16 January 1945.

The paratype is deposited in the reference collection of the Geology Department, University of Auckland, Palaeontology Catalogue No. G 5868. It is a broken shell collected from the Te Piki Shellbed, N62/505, 5-7½ feet above the main road, M. Chapman-Smith, 1968; age: Castlecliffian.

*Discussion.* This fossil species is known from only three broken specimens. *Philine columnaria* Hedley & May, 1908, a recent species from Australia is also spirally sculptured. However the general shape of the shell and the extent of the sculpturing is quite different (Burn, 1969).

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## CONCLUSION

The genus *Philine* is widespread, species being found from tropical to polar regions. They commonly burrow in soft sediments from the inter-tidal zone to the benthic regions. All species so far studied are active carnivores ingesting and crushing hard-shelled bivalves, gastropods, worms and foraminiferans. *Philine aperta*, a European species ingests its prey, the tube worm *Pectinaria*, by everting the buccal bulb and grabbing with the now external radula (Hurst, 1965). Variations of this process have been found in two New Zealand species, *P. auriformis* sucking in *Nucula* without everting the buccal bulb, and *P. angasi* ingesting the bivalve *Chione*, with its everted buccal bulb. In the latter species the radula is small and degenerate and of no functional significance (Rudman, 1967). The family Philinidæ contains a number of doubtful genera, each with slight anatomical or shell differences. A comparative study of the anatomy of this group was not possible at this stage and, until this is done, one cannot discuss the relationships of the New Zealand species either to one another, or to other species described.

## ACKNOWLEDGEMENTS

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